

S O U R C E R E D U C T I O N



According to estimates made by the Congressional Office of Technology Assessment (OTA), the appropriate technology and adequate economic conditions already exist to reduce solid waste generation by 50 percent in the next few years. This chapter describes options for establishing source reduction programs in the government, commercial and public sectors, and for householders. It illustrates, by example, how to measure the success of such programs. It also lists references and sources that can provide decision makers with more details about designing and implementing specific source reduction programs.



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5 HIGHLIGHTS



Source reduction implies reducing waste at its original source.
(p. 5-5)

In this chapter source reduction implies reducing the volume or toxicity of waste at the source by changing the material-generating process; it includes incorporating reduction in the design, manufacture, sale, purchase, and use of products and packaging. Other terms are often used to mean source reduction, including waste reduction, waste prevention, waste minimization, pollution prevention, and precycling.

Source reduction includes several strategies.
(p. 5-6)

Source reduction reduces the amount of materials we produce and the harmful environmental effects associated with producing and disposing of them. It includes:

- reduced material use in product manufacture
- increased useful life of a product through durability and repairability
- decreased toxicity
- material reuse
- reduced/more efficient consumer use of materials
- increased production efficiency resulting in less production waste.

Source reduction offers several opportunities for cost savings.
(p. 5-7)

- direct savings
- avoided waste collection, transportation, and disposal costs
- decreased pollution control, liability, and regulatory compliance costs
- reduced product and material use and disposal costs

Source reduction legislation often focuses on establishing the following:
(p. 5-7 — 5-9)

- specific goals
- government procurement and purchasing requirements
- packaging requirements and guidelines
- labeling guidelines
- business planning and reporting requirements
- banning yard trimmings from disposal
- banning specific chemicals and types of packaging

Both economic incentives and disincentives can be used to encourage source reduction.
(p. 5-9 — 5-10)

Economic *incentives* include the following:

- funding research and development of source reduction and education programs, developing source reduction measurement standards, and improved product designs
- funding waste exchanges
- funding other materials reuse programs and businesses
- subsidizing repair businesses
- providing tax credits or exemptions to industries that meet set goals or design criteria.

Economic *disincentives* include the following:

- creating taxes that reflect disposal costs of packaging
- placing taxes on use of virgin materials when recycled materials would work
- taxing disposal products
- instituting volume-based rates for waste collection programs.



Waste audits are a key to establishing source reduction programs.
(p. 5-10 — 5-11)

Waste audits are the key to establishing a successful source reduction program. They involve assessing the material flow through an institution and preparing accounting for the amount of materials purchased, used, recycled, and disposed of. A waste audit includes the following steps:

- describing current purchases, use and disposal requirements and methods
- identifying amounts and types of materials generated, including those to target for source reduction
- estimating cost savings
- implementing and monitoring the program.

Selective purchasing is another strategy for source reduction.
(p. 5-11 — 5-12)

Organizations, institutions, and individuals can preferentially purchase products that are durable, reusable, and repairable; buy in bulk; and avoid purchasing single-use products. They can also consider a product's solid waste and toxicity production, recycled content, packaging, resource use, and ultimate disposal. Shifting purchasing priorities toward source reduction might entail rewriting purchasing codes and reviewing and updating material classifications based on new product developments. It is important for solid waste, environmental, and purchasing officials at all levels of government to work together in planning, implementing, and monitoring source reduction programs.

Source reduction programs for businesses and other institutions may include several elements.
(p. 5-13 — 5-14)

- support and policy directives from management
- a waste reduction team or coordinator
- accounting of materials purchased and waste produced
- reduction plan targeting materials and production practices
- employee education
- feedback and reevaluation
- produce or sell products designed to be reusable and more durable

Source reduction strategies for industries include the following:
(p. 5-14 — 5-15)

- manufacturing redesign
- product redesign
- designing products with durability, reuse, and ease of repair in mind
- initiating "in-house" source reduction programs at company facilities

5 HIGHLIGHTS (continued)



Businesses and other institutions can also implement a number of source reduction strategies.

(p. 5-15 — 5-16)

- Copy double sided.
- Use electronic mail.
- Circulate only one copy of printed material (memos, documents); use routing slips indicating who should read it and who has already seen it.
- Establish central document and file areas.
- Reuse paper that has been printed on only one side.
- Reuse and return corrugated boxes.
- Purchase cooperatively; order supplies in bulk with other businesses or institutions (for example, cleaning products).
- Establish a waste exchange with other nearby businesses (for example, merchants sharing a mall).
- Sell items in reusable containers.
- Provide items in bulk and encourage shoppers to buy in bulk.
- Provide shoppers with incentives to reuse store packaging.

A focus on packaging is another source reduction strategy.

(p. 5-16)

Packaging should protect products from chemical and physical damage. Once this goal is achieved, source reduction decision-making guidelines for packaging professionals should be followed to evaluate each type of package design. Source reduction considerations should be incorporated into all packaging to the extent possible. To assess packaging, the following should be considered.

- Evaluate the need for any package at all.
- Decide if any of the package components can be eliminated.
- Assess the use of toxic chemicals and replace them with less harmful chemicals using the smallest amount possible.
- Design a package that is reusable.
- Find ways to reduce the package size or use of materials.

Source reduction programs aimed at consumers and residents can achieve significant benefits.

(p. 5-18 — 5-22)

An aggressive source reduction campaign for the residential/consumer sector involves using a variety of approaches, in addition to regulatory tools. Decision makers can consider using the following:

- economic incentives, such as unit-based garbage fees
- education, technical assistance, and promotions aimed at increasing participation in source reduction activities like yard material reduction programs and precycling
- investment in source reduction tools such as materials exchange databases or providing backyard composting bins
- regulations and legislation.

5

SOURCE REDUCTION

UNDERSTANDING AND FOSTERING SOURCE REDUCTION

Defining Source Reduction

The USEPA considers source reduction the highest priority method for addressing solid waste issues.

Source reduction implies reducing waste at the source by changing the material-generating process, and also includes incorporating reduction in the design, manufacture, sale, purchase, and use of products and packaging.

In its *Agenda for Action* (1989), the U.S. Environmental Protection Agency gave source reduction the highest priority as a method for addressing solid waste issues. Because it minimizes the creation of materials and toxics, source reduction is the only practice that is preventative. This proactive approach also reduces material and energy use. Recycling, composting, waste-to-energy, and landfilling are reactive methods for recovering and managing materials after they are produced.

The USEPA defines source reduction as the design, manufacture, purchase or use of materials to reduce their quantity or toxicity before they reach the waste stream. The National Recycling Coalition (NRC) adopted a somewhat different definition in its “Measurement Standards and Reporting Guidelines.” They define source reduction as “any action that avoids the creation of waste by reducing waste at the source, including redesigning of products or packaging so that less material is used; making voluntary or imposed behavioral changes in the use of materials; or increasing durability or re-usability of materials.” NRC adds that source reduction “...implies actions intended to encourage conservation of materials.” Others have added to the definition the caution that source reduction should not increase the net amount or toxicity of wastes generated throughout the life of a product. Although national policy denotes that it is the highest priority waste management technique, currently there is no universally accepted definition of source reduction.

Several terms are often used to mean source reduction. These include waste reduction, waste prevention, waste minimization, pollution prevention, and precycling. The precise meanings may depend on the context in which the terms are used. USEPA often uses the term “waste prevention” in lieu of source reduction. Source reduction as used in this chapter implies reducing waste at the source by changing the material-generating process, and also includes incorporating reduction in the design, manufacture, sale, purchase, and use of products and packaging. Source reduction programs can be targeted to reach consumers (often known as “precycling”) as well as manufacturers. Waste reduction is a broader term encompassing all waste management methods, i.e., source reduction, recycling, and composting, that result in reduction of waste going to the combustion facility or landfill. Waste minimization refers to activities specifically designed to reduce industrial hazardous and toxic wastes as they affect land disposal as well as contribute to air and water pollution. Pollution prevention includes input optimization, the reduction of nonproduct outputs, and production of low-impact products. Precycling refers to the decision-making process that consumers use to judge a purchase

based on its waste implications; criteria used in the process include whether a product is reusable, durable, and repairable; made from renewable or nonrenewable resources; over-packaged; or in a reusable container.

Source Reduction as a First-Choice Approach

Source reduction reduces the amount of materials produced and the harmful environmental effects associated with producing and disposing of them.

Promoting source reduction is important because it conserves resources, reduces disposal costs and pollution, and teaches conservation and prevention. It should, therefore, be given first consideration. Focusing only on recycling might promote the impression that recycling will take care of our waste problems. Source reduction and recycling, while important to distinguish from each other, can be promoted simultaneously. Source reduction is becoming recognized as a key component of integrated waste management. While its implementation is in its infancy, creative source reduction strategies are being developed and applied across the nation.

Source reduction is a practical approach to reducing the amount of materials we produce and the harmful environmental effects associated with producing and disposing of them. The basic elements of source reduction include the following:

- reduced material use in product manufacture
- increased useful life of a product through durability and repairability
- decreased toxicity
- material reuse
- reduced/more efficient consumer use of materials
- increased production efficiency resulting in less production waste.

Tradeoffs between source reduction, durability, recyclability, use of recycled material, and other environmental benefits can occur. If known, these should be noted and analyzed. The process resulting in the greatest overall environmental benefit should be chosen.

Life cycle analysis details all resources used and the products and by-products generated throughout a product's entire life.

Ideally, to assess and quantify these tradeoffs, a life cycle analysis would be performed. Life cycle analysis is a detailed look at all resources used and the products and by-products generated throughout the entire life of a product or process. The cradle-to-grave analysis (1) starts with raw materials and energy acquisition, (2) then examines manufacturing and product fabrication; filling, packaging, and distribution; and consumer use and reuse; and (3) ends with analysis of waste management. Currently, life cycle analysis procedures are being developed to assess the overall environmental impact of products and their packages. Until there are standardized methods for performing a life cycle analysis, results from such studies may not be comparable or reliable. USEPA is working on guidelines for a more consistent approach to life cycle analysis. Even when the guidelines are complete, however, conducting a life cycle analysis will still be too complex and expensive for most local solid waste managers.

Measuring Source Reduction

Monitoring should be an integral part of source reduction programs. Although standardized methods to measure source reduction have yet to be developed, tracking the costs associated with source reduction and integrating them into the decision-making process is essential to developing accountability. Monitoring also facilitates evaluating programs for efficiency and identifying possible source reduction measures and program revisions. Tracking the effectiveness of source reduction initiatives is also important for obtaining funding and resources for these programs.

Source reduction is more difficult to measure on a broad scale than other methods of solid waste management. It is difficult to measure what hasn't

Quantifying source reduction program results is in the early stages of development.

been produced, and to discern which reductions are due to prevention and which are due to other factors such as the economy, business cycles, or seasonal changes. When several waste reduction techniques are used simultaneously, it is not easy to determine which portion of the diversion was due to source reduction, for example, separating it from recycling or composting. However, on a company-by-company and product-by-product basis, measurements such as the savings achieved by substituting one product with another are obtainable.

Quantifying program results through accepted measurement techniques is in the early stages for most types of waste reduction practices and to a greater extent, for source reduction. A small amount of source reduction data has been collected, but without established measurement tools, the accuracy of some reports is questionable. This chapter presents examples of programs that have measured source reduction success.

Source reduction often results in substantial and measurable cost savings. These include avoided collection, transportation, and disposal costs, and direct savings. In addition, source reduction is cost efficient in decreasing pollution control, purchase, use, and regulatory compliance costs. It also reduces product and material use and disposal costs in the manufacturing process, making business operations more efficient overall. There is some concern that source reduction might reduce economic growth by decreasing consumption. However, source reduction offers opportunities for economic gain. Many businesses are becoming more competitive through source reduction practices and others are finding that products designed for source reduction achieve significant sales.

The technology and economics exist for industry to reduce solid waste by 50 percent.

According to Congressional Office of Technology Assessment (OTA) estimates, the technology and economics exist for industry to reduce solid waste by 50 per cent within the next few years. This chapter describes options for establishing source reduction programs in the government, commercial, and public sectors, and illustrates, by example, how to measure their success. It also provides references which can provide decision makers with more details about designing and implementing specific source reduction programs.

SOURCE REDUCTION POLICY

Regulation

Legislation and regulation governing source reduction programs are increasing.

Legislation and regulation governing source reduction programs are increasing. Source reduction legislation often focuses on establishing the following:

- specific goals
- government procurement and purchasing requirements
- packaging requirements and guidelines
- labeling requirements and guidelines
- business planning and reporting requirements
- yard material bans
- specific chemical and packaging bans.

Education, including promotion, technical assistance, planning and reporting, and economic incentives are key elements of such legislation. To achieve a comprehensive policy approach, decision makers can focus on four strategies:

- “command and control” regulations
- economic incentives and disincentives
- education and technical assistance
- government financial support for source reduction practices (i.e., supplying bins for home composting of yard trimmings).

States may require local governments to institute specific source reduction practices.

Local governments might be required by state laws to institute specific source reduction practices. In many cases, decision makers can model local policy after state directives to promote source reduction in their own institutions and in commercial and residential sectors.

Some states, including Connecticut, Pennsylvania, Maine, New Jersey, New York, Massachusetts, and Michigan, have set source reduction goals that specify the percent of reduction to be achieved in designated years. To be most effective, the goals also include a baseline year to measure from and measurement procedures. Establishing source reduction goals can be important in ensuring that source reduction programs are established and funding and staff are allocated.

Wisconsin and Connecticut statutes direct state agencies to modify purchasing to discourage buying single-use, disposable products and encourage purchasing multiple-use, durable products. Connecticut's model establishes specific goals and deadlines for achieving reduction. Local governments can apply such policies as well.

Acts in Minnesota and Wisconsin target the elimination of excess packaging. New packaging can be reviewed to assess its potential impact on solid waste disposal and the availability of markets for recycling it. If it is determined to be "problem" packaging, it can be banned from sale in the state.

The Coalition of North East Governors (CONEG), which includes nine northeastern states, formed a Source Reduction Task Force in 1988. To achieve source reduction, they recommended voluntary source reduction by industry, establishment of consistent goals and standards, coordinated education, and incentives and disincentives. In addition, a Northeast Source Reduction Council was formed comprising members from government, industry and nonprofit groups. The council developed a set of "Preferred Packaging Guidelines." The guidelines recommend a hierarchy of packaging practices: no packaging; minimal packaging; consumable, returnable, or refillable (refill at least five times) reusable packaging; and recyclable packaging or recycled material in packaging.

Well-conceived labeling requirements and guidelines for products and packaging may help prevent waste.

Labeling requirements and guidelines for products and packaging can help prevent waste if they encourage consumers to choose products that generate less waste and if they encourage labels that are specific and accurate. In 1992, the Federal Trade Commission adopted guidelines for the use of labels which give examples of deceptive and non-deceptive claims, including source reduction claims. Some states, such as California, New York and Rhode Island, have established requirements for specific labels such as those for products with recycled content.

Legislation can also include limits on toxic content of products, review of new and existing products for undesirable components and characteristics, conditional bans on product sale or use based upon design criteria, and requirements for manufacturers to submit source reduction plans.

Some municipalities have also adopted source reduction legislation. They have set goals and banned certain packaging and disposable products from sale. Seattle, Washington has set a 1.9 percent source reduction goal and a 0.6 percent backyard composting goal.

Rhode Island requires businesses to submit detailed source reduction (and recycling) plans to the state. This was phased in for larger (500 or more employees) to smaller businesses (100 plus employees) between 1989 and 1990 and for small (less than 50 employees) businesses in 1991. They must conduct a waste audit and submit a detailed analysis, submit proposals for effective reduction and recycling, and prepare an annual report quantifying results. Businesses have 60 days to activate the plan before inspection by the state. Businesses totaling one third of Rhode Island's work force have submitted plans and have already realized large savings in avoided disposal costs.

The source reduction techniques used most frequently by 274 Rhode Island companies include double-sided copying (52 percent), reuse of shipping

materials (31 percent), reuse of assorted materials (28 percent), and asking suppliers to reduce packaging (26 percent).

The Rhode Island study also found that materials exchanges were underused but that there is great potential for their use. A majority (63 percent) of businesses were interested in using this tool, with wood pallets and plastics the most likely possibilities for feasible exchanges.

New York City is considering requiring businesses of targeted sizes to perform and submit waste audits and to meet reduction goals according to a specific timetable.

Yard material, excluding grass left on the lawn and backyard compost materials, constitutes a significant portion of the waste stream: it comprised 18 percent of the 180 million tons of municipal solid waste generated in the United States in 1990. Fourteen states have adopted legislation banning yard material from landfills. Some programs include bans on leaves only, while others include garden debris and grass.

Banning items such as excess packaging is another source reduction tool. A Minneapolis/St. Paul ordinance bans any packaging that does not meet the test of “environmentally acceptable,” which is defined as (1) reusable at least five times, (2) biodegradable (except plastic), or (3) recyclable in the city’s recycling program.

Packaging bans, however, are not source reduction legislation unless they encourage reusable packaging or packaging with lesser amounts of materials. Replacing disposable packaging with recyclable or compostable packaging would not qualify as source reduction unless the new package created less waste at the source. Decision makers considering bans should be aware of the difficulties associated with this controversial tool and should thoroughly research the legal ramifications before imposing a ban. Problems with interstate, regional, or local commerce laws might arise.

Fourteen states ban yard trimmings from landfills.

Decision makers considering bans should be aware of their controversial nature and anticipate possible legal ramifications.

Economic Incentives and Disincentives

There are many ways that state and local governments can promote source reduction. Governments can fund research and development of source reduction programs, education programs, measurement standards, and product design. Funding materials exchanges is another method. The Minnesota Public Interest Research Group (MPIRG) operates the BARTER program, an information exchange for reuse of shipping and packing materials for small businesses. The New York City departments of Sanitation and Cultural Affairs together operate a reuse program, “Materials for the Arts,” which matches business donations with the needs of nonprofit arts organizations. They pick up tax-deductible contributions of goods and equipment from businesses and individuals and take them to a warehouse for free pick-up by nonprofit organizations.

Subsidies for repair businesses or reuse organizations can be provided. Also, repair training programs at technical colleges can be supported. Local governments can sponsor programs or create opportunities for volunteer programs such as neighborhood repair centers or neighborhood tool banks. Governments can also provide incentives to manufacturers in the form of materials tax credits. Tax credits or exemptions can be given to industries that meet set goals or design criteria.

Taxes that reflect the disposal costs of packaging material can be applied at the manufacturing or the consumer levels. These are financial disincentives. At the manufacturing level, a tax can be placed on products with excessive packaging. A tax on each package produced regardless of its contribution to the waste stream is another method used. Such taxes are used in Florida and can be costly and cumbersome to administer in the initial years.

Taxes also can be placed on single-use products. The advantages of such taxes are that they include at least some of the true cost to society of the product and its package and, like the variable container rate on refuse, are fair in

There are many ways that state and local governments can promote source reduction.

More than 2,000 communities have unit-based garbage rates, which encourage manufacturers and consumers to reduce, reuse, and refill.

charging the generators responsible for producing the waste. The CONEG Task Force recommended adoption of a per-container charge system to encourage consumers to purchase less packaging.

Wisconsin mandates unit-based rates or user-fee collection programs for all municipalities and counties that do not achieve a 25 percent landfill diversion rate. In addition to the inherent economic incentive to reduce waste in a unit-based system, Wisconsin offers additional grant monies to communities that implement the fee system. Although the legislation doesn't go into effect until 1995, more than 200 communities had instituted rate-based rates at the local level by 1993.

Minnesota required by January 1993 that all municipalities make the pro-rated share of garbage collection and disposal costs for each generator visible and obvious to the operator. Licenses must require that charges increase with the volume or weight of waste collected after a base unit size of service is provided.

More than 2,000 communities have instituted unit-based garbage rates. This kind of rate system provides manufacturers and consumers with an economic incentive to reduce, reuse, and refill.

Mandating minimum lengths for service warranties is another policy tool. This encourages the development and production of longer-lasting products.

GOVERNMENT SOURCE REDUCTION

Local government leaders can implement source reduction programs at three levels in their communities: (1) at the institutional level—local government of fices and other facilities, such as schools, parks, city works garages, libraries, etc., (2) at the business/industry level, and (3) at the residential level. By implementing source reduction programs in their own offices and facilities, local governments not only reduce their own waste but also show their commitment to such programs. They can use their own source reduction experiences to illustrate the benefits of source reduction when developing similar programs in the commercial and residential sectors of their communities.

Facility Source Reduction Programs: Performing Waste Audits

Guidelines for establishing source reduction programs in local government institutions are similar to those for establishing commercial source reduction programs. This section describes the components of a successful program at the institutional level.

The key to establishing a successful source reduction program is the waste audit or assessment. Local government managers can perform a waste audit by following the methods detailed below. Some cities have staff who perform waste audits for local businesses or for government facilities.

A waste audit is an assessment of material flow through an institution. It is a detailed accounting of the amount of materials purchased, used, recycled, and disposed of. Because a waste audit forces a scrutiny of the path each material takes through a facility, it clarifies an otherwise complicated morass of materials that can differ from department to department within a facility. Audits help identify the points at which changes in purchasing, consumption, and use can reduce or eliminate material.

A waste audit includes the following steps: quantifying current disposal costs and discarded material; identifying and quantifying materials that are unnecessary, reusable and recyclable; estimating cost savings; and implementing and monitoring the program.

- **Describe current disposal:** Examine size of refuse containers, percent filled, volume contained, density, frequency of collection and costs of collection. Published generation rates by type of facility such as restau-

Waste audits or assessments are the keys to successful source reduction programs.

Waste audits include the steps described here.

rant, office, and schools, are available from industry and government documents. These provide estimated pounds generated per person per month. Multiply the rates by number of employees or residents.

- **Identify materials to target for source reduction:** Determine material composition in a facility by listing each type of material that enters it and all materials and waste it generates, such as paper, aluminum cans, metal shavings, plastic bags, corrugated boxes, and chemicals. List where they are stored or used (facility-wide or in a particular department) and estimate the amount of each recycled or discarded per month. Note the availability of alternatives or ability to reduce or reuse items in the facility.
- **Estimate cost savings:** Include avoided disposal costs, avoided material purchase costs, avoided replacement costs, and costs of reused alternatives and revenues from marketing scrap. Determine costs of backhauling, transportation for refilling, etc., and processing equipment, if the costs apply.
- **Implement and monitor the program:** Choose which measures to implement, keep records of material purchased, scrapped, reused, backhauled, and disposed of. Measure savings over the long term; estimated savings will not be realized immediately. Refine and adjust the program.

Work sheets can help guide waste audits and are available from many local and state government agencies.

Work sheets to assist in performing an audit are available as part of commercial recycling handbooks produced by many local and state government agencies. Some of these include Rhode Island, (OSCAR), 1988, "Handbook for Reduction and Recycling of Commercial Solid Waste"; The Alaska Health Project, 1988, *Profiting from Waste Reduction in Your Small Business: A Guide to Help You Identify, Implement, and Evaluate an Industrial Waste Reduction Program*; Mecklenburg County, North Carolina, 1988, *Possibilities and Practicalities of Business Waste Recycling*; and Seattle, Washington, 1989, *Commercial Waste Reduction Audit Manual*.

USEPA publications are also available as resources to help businesses. For example, the *Business Guide for Reducing Solid Waste* (EPA/530-K-92-004) offers step-by-step instructions designed to assist medium and large businesses, governments and other organizations establish waste reduction programs. It also includes work sheets. This publications and others are available free from the USEPA RCRA/Superfund Hotline: 800/424-9346.

Purchasing

Government procurement policies emphasizing source reduction can significantly impact the waste stream.

Government procurement policies that make source reduction a priority can achieve a significant impact on the waste stream. Collectively, government represents approximately twenty percent of the gross national product (GNP) of the United States. As a result, the purchasing power of government can influence manufacturing practices towards implementing source reduction goals. Also, by implementing source reduction practices, government sets an example for business, industry and the public.

As is done in consumer source reduction programs, state and municipal governments can preferentially purchase products that are durable, reusable, and repairable; buy in bulk; and avoid purchasing single-use disposable products. Also, governments can consider a product's solid waste and toxicity production, packaging, resource use, and ultimate disposal. Shifting purchasing priorities toward source reduction might entail rewriting purchasing codes and reviewing and updating material classifications based on new product developments. It is important for solid waste, environmental and purchasing officials at all levels of government to work together in source reduction program planning, implementation and monitoring.

When government personnel evaluate proposals for equipment and furniture purchases, they can include source reduction criteria in the decision-making process. Those products that offer extended warranties can receive

extra points based on the number of years covered beyond the industry standard. ASTM standards for quality and durability of products can also be used. In a request for proposal (RFP), a guaranteed buy back for equipment and furniture can be requested. Also, consider costs of maintenance and supplies needed for equipment as part of the bid evaluation. Purchases can also be evaluated based upon the methods available for disposal of the item at the end of its useful life. Those methods ranked the highest based upon a source reduction priority are: trade-in for a newer model, resale, and salvage of components for repair or maintenance of like items.

Intergovernmental arrangements for bulk purchasing enhance the economics of source reduction programs. Cooperative purchasing can occur between states or municipalities, or municipalities can piggyback off state purchasing. Municipalities can co-purchase and share equipment (such as a tub grinder) on a scheduled basis.

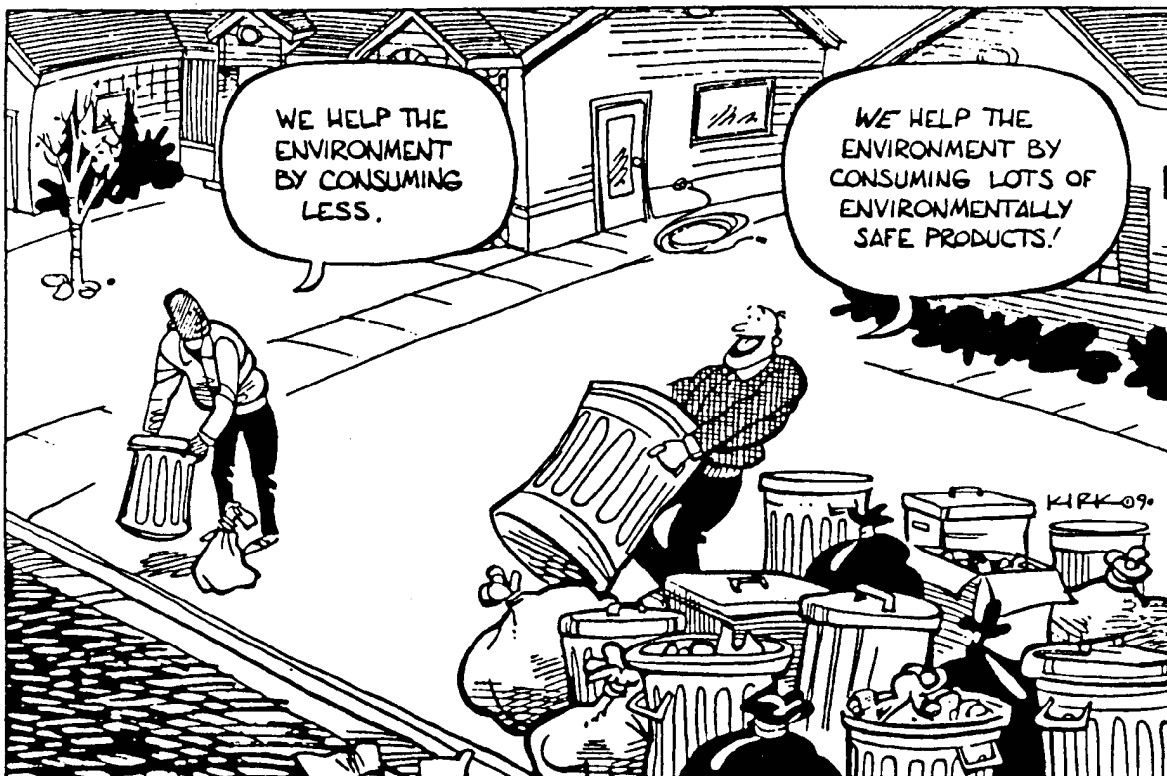
In addition to changing procurement procedures, local governments can consider implementing other source reduction activities.

Purchasing products made with recycled content helps to make recycling a viable process by creating and sustaining markets for used materials, but it is not a source reduction practice. Although recycled products keep otherwise usable materials out of the waste stream, there is a difference between using fewer products overall and using the same or greater amounts of recycled products (see Figure 5-1).

In addition to changing procurement procedures, local governments can consider implementing other source reduction activities, including decreasing yard material at municipal facilities, changing office procedures and employee behavior (for example, implementing two-sided copying), and ordering only the amount of printed materials needed (print on demand), as well as other measures, which are described in the section below on commercial source reduction programs.

Figure 5-1

(Released by Kirk Anderson, Cartoonist)



As a large consumer of paper and materials, the government sector can decrease material use considerably by implementing such measures. For example, Itasca County, Minnesota installed reusable stainless steel furnace and air conditioning filters in 60 units in their garages. Annually, this measure saves 3,120 disposable filters or 53 cubic yards of waste weighing 1,040 pounds. It also saves the county approximately \$4,700 per year.

COMMERCIAL (INDUSTRIAL AND BUSINESS) SOURCE REDUCTION

Source reduction programs should also be adopted in the commercial, business, and consumer sectors.

In addition to government source reduction efforts, significant opportunity exists for developing source reduction programs in the commercial, business, and consumer sectors of each community.

Decision makers can encourage individuals and organizations in their commercial sectors to adopt source reduction programs by providing the following:

- model source reduction programs in government facilities
- technical support such as a hot line, waste assessments or training materials, workshops for targeted generators, and resource information
- education about the economic benefits of source reduction
- public/private partnerships
- awards for source reduction.

A source reduction program for businesses might include the components described below:

A source reduction program for businesses might include the components listed here.

1. **Support and policy directives from management:** Such directives indicate commitment and allow company staff the time and resources to measure for and plan a source reduction program, and then to integrate it into company procedures. Incorporate source reduction achievement standards into individual employee job duties, evaluations and/or bonuses.
2. **A waste reduction team or coordinator:** This team or individual develops the source reduction plan, explores alternative materials and options, works with employees to brainstorm for new ideas, implements and monitors the program, and researches new source reduction developments in order to improve or expand the program.
3. **Accounting of materials purchased and waste produced:** A waste assessment will provide information about the types and quantities of materials purchased, used, reused, recycled, composted or discarded, where and how often they originate and are discarded within the business, and the costs associated with them. This information is critical for identifying cost-effective and practical source reduction actions a company can take.
4. **Reduction plan targeting materials and production/practices:** With information from the waste assessment, formulate a plan to do the following:
 - reduce inefficiencies in material and equipment purchasing and use by buying in bulk
 - buy durable products and equipment
 - identify and incorporate alternative materials that are less toxic or less wasteful
 - identify items that can be reused often
 - identify sources of over packaging and avoid or return the packaging or packing material for reshipment
 - offer alternatives to disposables and indicate costs associated with each.

5. **Employee education:** Inform employees of source reduction goals and teach them what they can do to help achieve them. Provide incentives.
6. **Feedback and reevaluation:** Through newsletters, memos, handbooks, bulletin boards, meetings or awards, inform employees of successes as well as areas where more source reduction can be achieved. Inform them of any additions, restructuring, or modifications to the programs.
7. **Produce or sell products designed to be reusable, more durable and recyclable:** Also attempt to incorporate recycled materials as feedstock into products and purchase recycled materials (although this is not source reduction by definition, it is an integral part of a materials management program).

Many guidelines for business source reduction programs are similar to those for recycling programs.

Many of the guidelines for establishing a source reduction program for businesses are similar to those for setting up a recycling program. Source reduction should be the initial focus of business waste management plans with other materials management methods tailored to the resultant smaller (reduced) waste stream. Developing monitoring systems for material, product, and equipment quality and quantity will help to improve production efficiency. This will allow businesses to measure source reduction, monitor program progress, and increase the likelihood that they achieve source reduction goals.

Source Reduction Implementation Guidelines For Industries

To implement a source reduction plan, local governments can teach and encourage industry representatives to do the following:

Source reduction plans can encourage industry representatives to do several things.

- recover plant materials such as solvents, scrap metal, plastic, paper and other scrap, cooling waters, and oil
- reduce plant scrap by increasing production efficiency
- produce only what is needed to fill an order
- reuse pallets and have damaged ones rebuilt
- reuse and refill containers, such as Gaylord boxes, plastic bags, and drums
- return packing materials and pallets, back-haul via trucker, train, barge, or airplane
- reuse packing material
- redesign products to achieve source reduction in packaging and manufacturing materials
- use materials obtained through a materials exchange program in place of virgin feedstock.

Manufacturing Redesign

Making changes in the manufacturing process and product redesign are important source reduction strategies.

Making changes in the manufacturing process itself is an important strategy for achieving source reduction, which industry representatives should be encouraged to consider. An example of manufacturing redesign that successfully achieved source reduction is provided by Ciba-Geigy Corporation, based in Ardsley, New York. The company's McIntosh, Alabama plant produced 2.5 pounds of industrial waste material for every pound of additive, or twenty million pounds of waste a year. The corporation changed each step of the production process and was able to completely eliminate generation of this waste material. The corporation factors disposal costs into production costs; therefore, each department must account for use and disposal of material and has an incentive to reduce.

Product Redesign

Product design changes are another important element of source reduction. Benefits to industry from product redesign include additional cost savings in reduced shipping weight or space, less water usage (from concentrates), and reduced packaging materials and shelf space. Procter and Gamble provides an example of successful product redesign that resulted in source reduction. Changing the configuration of the wheel and cap of two brands of roll-on deodorant made stacking possible, which eliminated the need for additional shelf-stabilizing boxboard packaging containers. The new design uses 80 million fewer cartons, which results in 3.4 million fewer pounds of waste per year and reduces handling costs.

When considering product redesign, it is important to be aware of and carefully evaluate the frequent tradeoffs resulting from the ultimate waste produced by the product. Assess whether a product can be redesigned into a smaller or more concentrated form, since smaller items are produced with fewer materials. Source reduction is not necessarily achieved, however, if the smaller item is less durable or not repairable, or it is intended for short-term use (unless it is made of the same material as a larger version).

Concentrated products require less packaging material, but if the packaging for the concentrate is neither recyclable, nor significantly different in weight from the packaging for the nonconcentrated product, it might result in as much discarded material. When the source-reduced *nonrecyclable* package results in less overall material in the waste stream, source reduction is achieved. An example is a concentrated fabric softener packaged in a wax-coated paper carton versus the nonconcentrate in a recyclable (HDPE) plastic container. The single-use paperboard container contains 75 percent less material than the recyclable plastic container. In this case the nonrecyclable packaging should be given priority over a larger, recyclable package. The ideal option would be a source reduced product packaged minimally in a package made of recycled material that is also recyclable.

When considering product redesign, be aware of the frequent tradeoffs resulting from the ultimate waste produced by the product.

Other Industrial Source Reduction Strategies

Designing for Durability

Longer lasting, energy efficient light bulbs are an example of this. Steel belted tires are more durable than tires without steel reinforcement and therefore need to be replaced less often. In addition, they can be retread for reuse. This results in source reduction. A trade-off occurs, however, because it is currently difficult to recycle steel-belted tires and many end up in the waste stream.

Designing for Reuse

A reusable, collapsible plastic shipping container is one example. These containers nest to save space, are lightweight but strong enough for stacking to save warehouse space, and are recyclable at the end of their useful life. Although the initial costs are high as compared with shorter-lived corrugated shipping boxes and wooden pallets, cost savings can be realized over time from space efficiency and avoided disposal and purchasing costs.

Designing Products to Facilitate Repair

Modular components that can be selectively removed from items for repair increase the cost effectiveness of repair over replacement.

Source Reduction Implementation Guidelines For Businesses

To help businesses implement source reduction programs, local governments can encourage business representatives to adopt a number of source reduction strategies, including the following:

- Copy double sided.
- Use electronic mail.
- Circulate only one copy of printed material (memos, documents); use routing slips indicating who should read it and who has already seen it.
- Establish central document and file areas.
- Reuse paper by making it into scratch pads.
- Reuse and return corrugated boxes.
- Purchase cooperatively; order supplies in bulk with other businesses (for example, cleaning products).
- Establish a materials exchange among other surrounding businesses (for example, merchants in the same mall).
- Sell items in reusable containers.
- Provide items in bulk and encourage shoppers to buy in bulk.
- Provide shoppers with incentives to reuse store packaging.

A California company's polystyrene peanut reuse program is a successful incentive program for reducing packaging.

Table 5-1

Results of the Feather River Company's Polystyrene Peanut Reuse Program

No. of Bags Reused	Volume	Cost Savings
21/week	11 cu/yd	\$ 320
1092/year	572 cu/yd	\$16,640

Source: Feather River Company

An excellent example of the latter strategy is provided by the Feather River Company of Petaluma, California, which distributes body care products packed with polystyrene peanuts. Commercial customers save the peanuts and return them to the truck driver at the next delivery. Feather River Company does not purchase any new polystyrene peanuts. (See Table 5-1).

Another company, Nicolet Instrument Corporation, which produces high tech instruments in Fitchburg, Wisconsin, targeted several materials for source reduction. Based on the results of a waste assessment, they switched

A Wisconsin company targeted several materials for source reduction and realized significant savings.

Table 5-2

Results of Nicolet's Reusable Mug Program

Materials	No. of Cups/yr	Cost
Single-use cups	216,000	\$7,103 annually
Reusable mugs	950	\$2,707 one time

Source: Nicolet Instrument Corporation

to reusable thermal mugs. Nicolet purchased the mugs for employees and had them imprinted with its own recycling logo. The cost savings in materials used and waste generated are provided in Table 5-2. Other measures adopted by Nicolet include reusing solder and solvents; rebuilding pallets; and purchasing recharged toner cartridges and returning empty ones for refilling.

Different types of businesses can use source reduction strategies that are appropriate for their specific materials use and waste streams. For example, restaurant managers can include the following strategies, in addition to those listed above:

A Rhode Island restaurant's source reduction program saves \$2,900 annually and reduces disposal by 700 cubic yards.

Source reduction considerations should be incorporated into all packaging design.

A Texas company saved 360 of 750 tons per year of previously landfilled scrap wood and purchased 300 tons less of virgin wood.

- Use reusable utensils, dinnerware, napkins and place mats in restaurants for in-store serving.
- Sell beverages on tap, in bulk dispensers and in returnable bottles.
- Buy in bulk.
- Reduce single-serving packages for condiments by providing dispensers.
- Ask diners if they want a glass of water, condiments, straw and napkins.
- Evaluate shipping packaging to identify items that could be eliminated or reduced.

One restaurant that benefited from such measures is the Brick Alley Pub and Restaurant in Newport, Rhode Island, which formerly served beer in nonreturnable bottles. Their source reduction program consisted of installing a tap as well as purchasing beer only in returnable bottles. These measures resulted in cost savings of \$2,900 and disposal reduction of 700 cubic yards annually.

Packaging should protect products from chemical and physical damage. Once this goal is achieved, source reduction decision-making guidelines for packaging professionals should be followed to evaluate each type of package design. Source reduction considerations should be incorporated into all packaging design. To assess packaging, the following should be considered.

- Evaluate the need for any package at all.
- Decide if any of the package components can be eliminated.
- Assess the use of toxic chemicals and replace them with less harmful chemicals using the smallest amount possible.
- Design a package that is reusable.
- Find ways to reduce the package size. For example, by using the same type of packaging material, but in smaller amounts (by weight); by reducing the size or volume of the package relative to the product it contains; or by substituting a different, recyclable material that weighs less.

Successful source reduction involving packaging materials was achieved by PPG Industries, Inc. of Wichita Falls, Texas, which manufactures float glass that they package with wood. Their source reduction program decreases disposal and purchasing of wood and promotes local small business development. They created a storage area for some of the wood packaging for later reuse and arranged for a local company to rebuild packaging for company use. In the first year, PPG saved 360 of 750 tons per year of previously land-filled scrap wood and purchased 300 tons less of virgin wood. The resulting economic benefits for PPG Industries include the following:

- avoided disposal costs on 360 tons per year
- decreased packaging costs by 15 percent per year on recycled containers over virgin
- market revenues from wood of \$2,400.

In addition, the company rebuilding the wood packaging for PPG realized increased earnings of \$4,000 monthly and added 2.5 new jobs.

Ideally, it would be economically and technically feasible to recycle packaging when it reaches the end of its reduced and reused life. Packaging designed for reduction and reuse would ideally meet both these criteria, thus helping to achieve further overall waste reduction.

Other Examples of Source Reduction and Reuse by Businesses

- A laser printer service business, Shadow Fax in Madison, Wisconsin encourages reuse through cost incentives and reduction through longer

product life. Shadow Fax gives customers a cost credit for return of a laser printer toner cartridge for refilling. The cartridge is disassembled, any worn parts are replaced and it is refilled with new toner. They also rebuild cartridges with more durable parts, increasing their service life more than six times. Although the rebuilt cartridges are the same price as new ones, they are sold 90 percent more often. Cost credit incentive structure: New, in box \$89; rebuilt, increased durability \$89; recharged without core returned \$59; recharged with core for reuse \$49.

- Safety-Kleen, the world's largest recycler of contaminated fluids, operates automotive solvents recycling firms throughout the United States. Safety-Kleen developed a container to further reduce and reuse its business material which, in addition, is recyclable when it can no longer be reused. The plastic container for antifreeze, made with recycled plastic resin, was developed for reuse. When antifreeze is brought in for reclaiming, the container is refilled. When the container is at the end of its useful life, it is recycled into another reusable antifreeze container.

Safety-Kleen also developed a reusable and returnable dry-cleaning bag to replace disposable plastic dry-cleaning bags. More than one billion plastic dry-cleaning bags are landfilled each year. The average cost savings for switching to reusable bags for 125,000 to 150,000 garments per year, or 500 customers per month, is four to six thousand dollars annually. This program also includes hanger reuse and recycling resulting in a 40 percent cost decrease for hangers or up to three thousand dollars annually.

- Goodwill Industries of America is a nonprofit business that accepts and collects donations of used items such as clothing, small appliances, and furniture, some of which they repair or rebuild. A UCLA-Extension study developed methods to quantify diversion resulting from thrift stores and garage sales. They determined that 11,600 tons were diverted from thrift stores and 57,700 tons from approximately 164,900 garage sales in Los Angeles, California in 1990.

Other companies have also realized savings from source reduction programs.

SOURCE REDUCTION BY RESIDENTS

An aggressive source reduction campaign for the residential/consumer sector involves using a variety of approaches, in addition to the regulatory tools described earlier in this chapter. Decision makers can consider using the following:

- economic incentives
- education, technical assistance, and promotions
- investment in source reduction tools such as materials exchange databases or providing composting bins.

To illustrate how local decision makers implement these approaches, details of specific source reduction programs targeting the residential sector are provided.

Source reduction campaigns for the residential/consumer sector use a variety of approaches.

Local Source Reduction Economic Incentives: Unit-Based Garbage Fees

Unit pricing or unit-based garbage collection fees are economic tools that encourage residents to produce less waste. Municipalities institute a fee for each bag or can of refuse set out for collection. There are a variety of ways to design a pay-per-container system. All require that users pay for the amount of refuse they generate. In such systems, individual residents can reduce refuse collection costs by producing less refuse. This provides an economic incentive for source reduction, recycling and composting. A range of 25-50 percent reduction, primarily due to increased recycling and yard material diversion, has been reported by

Unit pricing or unit-based garbage collection fees encourage residents to produce less waste.

Unit-based container rates make the true cost of solid waste management apparent to consumers.

some communities in the first year unit-based rates are implemented. It is difficult to separate the smaller percent that is attributable specifically to source reduction.

Unit-based container rates help the resident understand the true cost of solid waste management. The rates usually incorporate the cost of refuse collection and disposal and, in some programs, subsidize recycling collection as well. There is often no extra charge to the resident for increasing amounts of recyclables collected. A flat fee for unlimited amounts of garbage collection and disposal is removed from taxes where it was often hidden under the general tax levy. Or a fee can be charged as a special assessment on taxes or placed on a utility bill to cover a base amount of service only.

Variable rates can be used for both curb-side and drop-off refuse and yard material collection programs. In addition, unit-based rate programs can be either publicly or privately operated. There are a variety of mechanisms for charging fees to residents. These include residents purchasing special trash bags, buying tags or stickers to affix to their own bags and containers, signing up for a specific size and number of cans, and paying by weight of garbage. A variation on these unit-based rate systems is a base rate system. Users all pay a set fee (base rate) for a given amount of service, and then pay per container for any garbage disposed of above the base amount. Limits to the size and weight of bags need to be set to prevent over-stuffing, and illegal dumping provisions in ordinances need to be enforced.

By 1994, more than 2,000 communities had implemented some type of unit-based rate program.

By 1994, more than 2,000 communities had implemented unit-based rate programs. The City of Seattle, Washington instituted unit-based fees in 1981. They used a variable can rate or charge based on the size of can each household signed up for with a mini-can of 19 gallons as the lowest option. Seattle has tested, on a pilot-program basis, a system in which each can is weighed at the truck and the weight recorded with bar code scanning for exact billings.

Because the amount of refuse produced can be reduced by source reduction, recycling, and composting, residents who “pay by the container” have an incentive to choose the products they purchase with each item’s waste potential in mind. Pay-per-container systems encourage source reduction by providing additional economic incentives to buy items with minimal packaging or in reusable containers.

Utica, New York uses unit-based rates for municipal refuse collection. Collection costs for refuse decreased from \$1.4 million to \$806,000 in one year. Recycling collection costs were an additional \$103,000. With the pay-per-container program, the volume of material at the landfill decreased by one third. (Note: the portion of landfill diversion attributable directly to source reduction as opposed to recycling is unquantified.)

Decision makers can learn more about volume-based rates in *Variable Rates in Solid Waste: Handbook for Solid Waste Officials, Volumes I and II* (USEPA Documents) and *Wisconsin Volume-Based Rate Collection Guide* (UW-Extension). USEPA will have a new unit pricing guide by June 1994.

Yard Material Reduction

Managing yard material at home can significantly reduce solid waste.

Local solid waste program managers can encourage residents to promote waste reduction by managing yard material at home. Although in this case the production of grass and leaves is not being reduced, using the material where it is produced rather than adding it to the waste stream is a form of source reduction. Residents should understand that leaving grass on the lawn is beneficial for the lawn. Backyard composting, leaving grass clippings on the lawn, and mulching are all source reduction measures. (These are described further in Chapter 7.) The “Don’t Bag It” campaign created by Plano, Texas has been adopted in eight states including Iowa, Missouri, and Louisiana. Milwaukee, Wisconsin uses a “Just Say Mow” program. Other states use master composter programs, demonstration compost sites, publications, exhibits, and posters to educate the residential and commercial sectors.

Master composting programs that teach residents how to build compost bins and make compost can be developed.

Local managers should emphasize the importance of using correct methods of backyard composting so that composting is not perceived as a public nuisance. Distributing guidelines to the public so they can learn how to avoid attracting animals and creating odors will help them to become successful composters.

Local solid waste program officials can organize master composting programs that teach residents how to build compost bins and make compost. The City of San Francisco contracts with a nonprofit, community-based group (SLUG—San Francisco League of Urban Gardeners) to provide composting information to residents. They provide educational literature, conduct workshops, and staff a “rotline.” The village of Skokie, Illinois provided tax rebates on mulching mowers for \$25 toward purchase of a new mower or one third the cost of a mulching attachment. Seattle, Washington distributes recycled plastic compost bins free to residents. They expect to recoup the costs of the bins within fifteen years due to avoided disposal costs. Keeping yard material at home can be more efficient for home owners, because it means less work than bagging yard material for collection or hauling it themselves to a drop-off or composting site.

Grasses have been developed that are slow growing and that stop growing at a particular height. Planting these grasses preferentially is an effective source reduction tool for yard material. Planting ground cover and spreading shrubs is another method of reducing the amount of grass produced. These practices can be used by local governments on municipal properties and demonstrated to the public.

Assessing the overall environmental effects of waste reduction strategies is important.

Removing trees or not planting trees to eliminate leaves and branches is not a viable source reduction strategy. It is important to assess the overall environmental effects of waste reduction strategies under consideration. In the case of trees, their positive environmental effects (for example, carbon dioxide intake and oxygen production) outweigh possible problems associated with the waste material they produce. Source reduction measures should not substitute one environmental problem for another or create different, but equally harmful effects.

Consumer-Based “Precycling” or “Eco-Shopping”

Local governments can promote source reduction in the residential sector by developing a strong education program. They can also create directories of re-use services such as rental outlets, repair shops, and outlets for used goods in their community; Seattle’s *Use It Again*, Seattle directory and Los Angeles’ *Put it to Good Use* are good examples.

Local programs should also publicize the consumer’s role in source reduction efforts, which might include basing decisions about purchases, not only on product attributes and costs, but also on packaging and alternatives to disposal. “Precycling,” or “eco-shopping,” refers to the decision-making process that consumers use to judge a purchase based on its waste implications. Criteria used in the process include whether a product is

“Precycling,” or “eco-shopping,” refers to the decisions consumers use to judge purchases based on the products’ waste implications.

- reusable, durable, and repairable
- made from renewable or nonrenewable resources
- over-packaged
- in a reusable container
- in a recyclable container (though not source reduction, this is part of eco-shopping education).

The impact that consumer behavior can have on source reduction is significant. For example, if 70 million Americans each bought one half gallon of milk in half-gallon containers, they would use 41 million pounds *less* paper and 6 million pounds *less* plastic in one year than if the same number of people bought the same quantity of milk in two, one-quart containers. Additional savings would include \$146 million in packaging and one trillion Btu’s of energy.

Some local education campaigns promoting precycling and source reduction were developed by Berkeley, California; New York City; and Seattle, Washington. Education efforts teach consumers to follow the 5R/C model: reject, reduce, reuse, repair, recycle and compost. Packaging makes up approximately thirty percent by weight and fifty percent by volume of municipal solid waste. For this fraction of the solid waste stream alone, consumer actions have enormous potential to reduce waste.

A local precycling and source reduction education campaign should include strategies that consumers can easily implement to purchase products based on how the product and packaging will be disposed of after use. Several such strategies are described below.

A local precycling and source reduction education campaign should include strategies that are easy to implement.

- **Bring reusable shopping bags:** The first step in precycling is arriving at the store with one or more reusable, durable shopping bags. An alternative is to take back paper or plastic grocery and shopping bags for reuse.
- **Buy concentrates:** Buying concentrates when available reduces packaging.
- **Buy in bulk:** Buying in bulk reduces packaging and is often preferable. However, buying in bulk achieves reduction only if the item purchased will be used before it spoils and becomes a waste. Consumers should, therefore, purchase items with unlimited shelf life in bulk and perishable items according to the rate of use.
- **Purchase reusable products:** Consumers should have the option of choosing reusable items instead of single-serving or single-use disposables. Reusable items include cloth napkins, wipes and tablecloths, china plates and reusable cups, silverware, rechargeable batteries, refillable razors and pens. Beverages purchased in bulk can be used as individual servings by pouring them into a reusable thermos. Nonrecyclable single-use drink containers result in considerably more waste than using a thermos. Plastic produce bags can be reused at the store. Plastic containers (that are not recyclable as yet), and steel coffee cans are packaging items that can be reused as storage containers in place of new items that might be purchased specifically for that function.
- **Purchase durable and repairable products:** Preferential purchase of durable and repairable products is another source reduction strategy. Evaluating product quality will result in both materials and cost savings over a product's lifetime. Energy-efficient, longer-lasting and replaceable light bulbs are everyday items that are more durable. Larger items such as appliances, cars, clothes and retread tires should be purchased for durability, maintained, and then repaired, rather than discarded. Maintaining items in good working condition, for example, keeping tires properly inflated, will extend their useful lives.
- **Buy secondhand items:** Purchasing secondhand items and donating other items to outlets for resale or reuse achieves source reduction. Shopping at garage sales is an excellent source reduction practice. Some items from Goodwill Industries and similar organizations, such as mattresses and small appliances, in addition to being used, have been repaired and refurbished. This is also true for items such as sports equipment, bicycles, lawn mowers and furniture.
- **Borrow or rent items when possible:** Borrowing or renting items, rather than purchasing them at all, achieves source reduction. If the item will be used only once or for a short time, avoid purchasing it. By borrowing or renting, consumers can test products and brands for efficient purchasing later.
- **Avoid over-packaged items:** Not purchasing products with excessive packaging is another strategy. Although the packaging was produced (and therefore not reduced at the source), when consumers reject excess packaging, it encourages manufacturers to adopt source reduction practices.

- **Be aware of products containing hazardous ingredients:** Consumer source reduction (precycling) education should also include information about the hazard level of products. One of the most significant consumer impacts comes from teaching consumers how to substitute alternative products that do not contain hazardous chemicals, how to identify such products, and how to use fewer of them.

Source reduction can occur when one product is substituted with another that has multiple purposes. If a product containing hazardous chemicals must be used, use one that contains fewer hazardous ingredients and a smaller amount of them.

Teach consumers to purchase only the amount necessary to accomplish a task so no or minimal hazardous waste materials are left over. Common household purchases containing hazardous materials include some types of cleaners, disinfectants, polishes, motor oil, solvents and garden pesticides and herbicides. Seattle distributes "safe cleaning kits" to residents in the region as part of its participation in a Regional Hazardous Waste Management Plan.

Another strategy to reduce the amount and toxicity of materials purchased is to encourage consumers to make a shopping list and a plan. This can help to eliminate impulse buying of items not really needed or of over-packaged, single-serving, convenience products. The plan should include estimates of the amount of an item needed; consumers can then avoid acquiring excess product that may become discarded. Comparison shopping can also achieve source reduction.

Labeling programs in grocery stores represent another precycling strategy that encourages source reduction. Champaign-Urbana, Illinois' model supermarket and Boulder, Colorado's "Stop Waste Before It Happens" campaign at grocery stores both use shelf labeling systems. Such programs can also consist of in-store signage, source reduction information booths, and letter writing campaigns aimed at manufacturers.

The materials from programs described above are resources available to local decision makers for use in modeling consumer source reduction education programs.

Several strategies exist to reduce the amount and toxicity of materials purchased.

Labeling programs in grocery stores are another precycling strategy to encourage source reduction.

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